Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

An anatomy of the forecast errors in the seasonal prediction system with EC-Earth

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ELIC Seminars-UCLouvain. Louvain-la-Neuve.

1. Experimental setup

- 7-months seasonal predictions starting in *May* and *November*. 10 members. Period 1993-2008. EC-Earth3.2

Initial conditions:

Atmosphere

ERA-Interim

Sea Ice

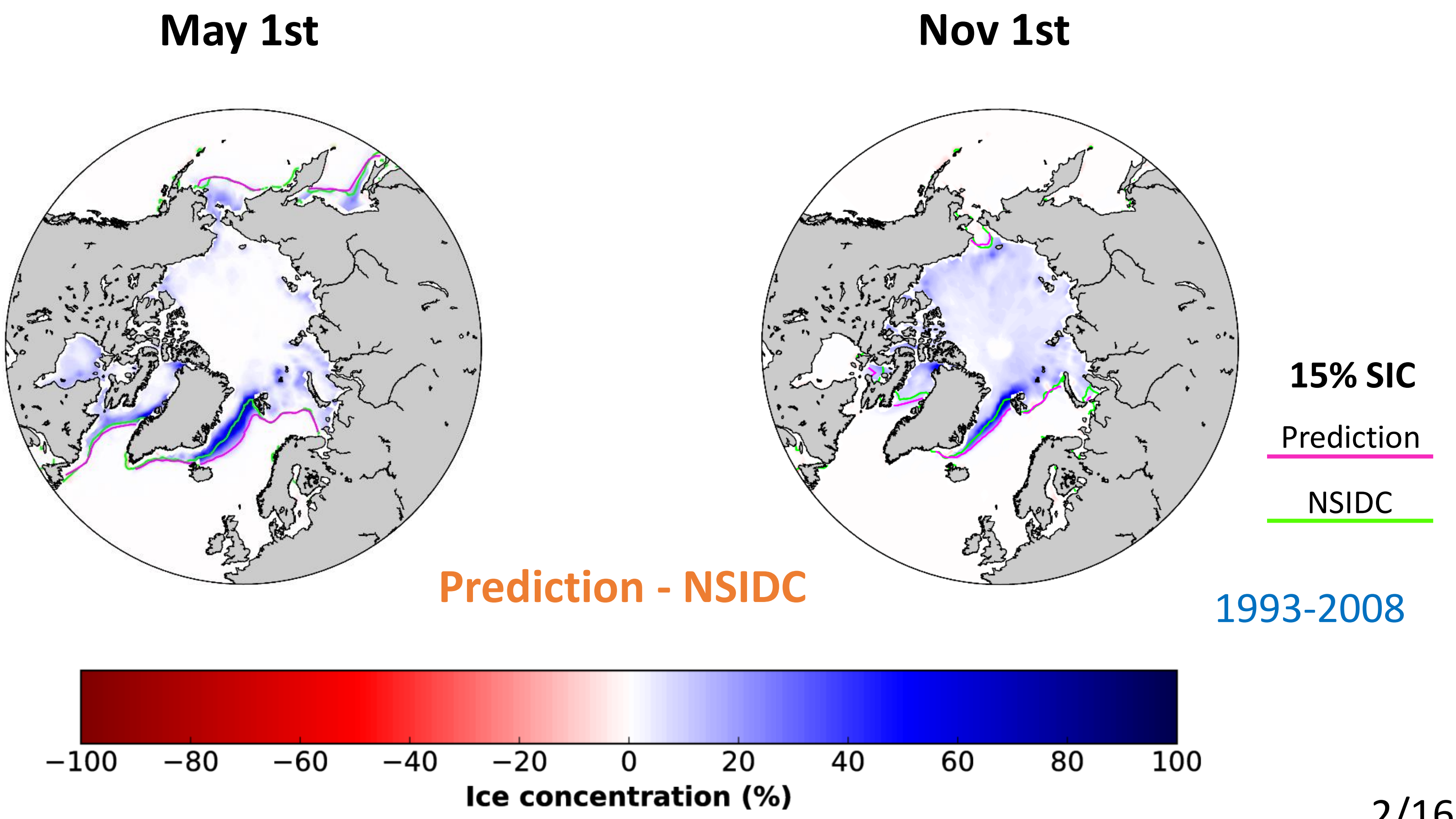
NEMO-LIM Standalone Reconstruction with assimilation of Sea Ice Concentration from ESA

Ocean

ORAS4

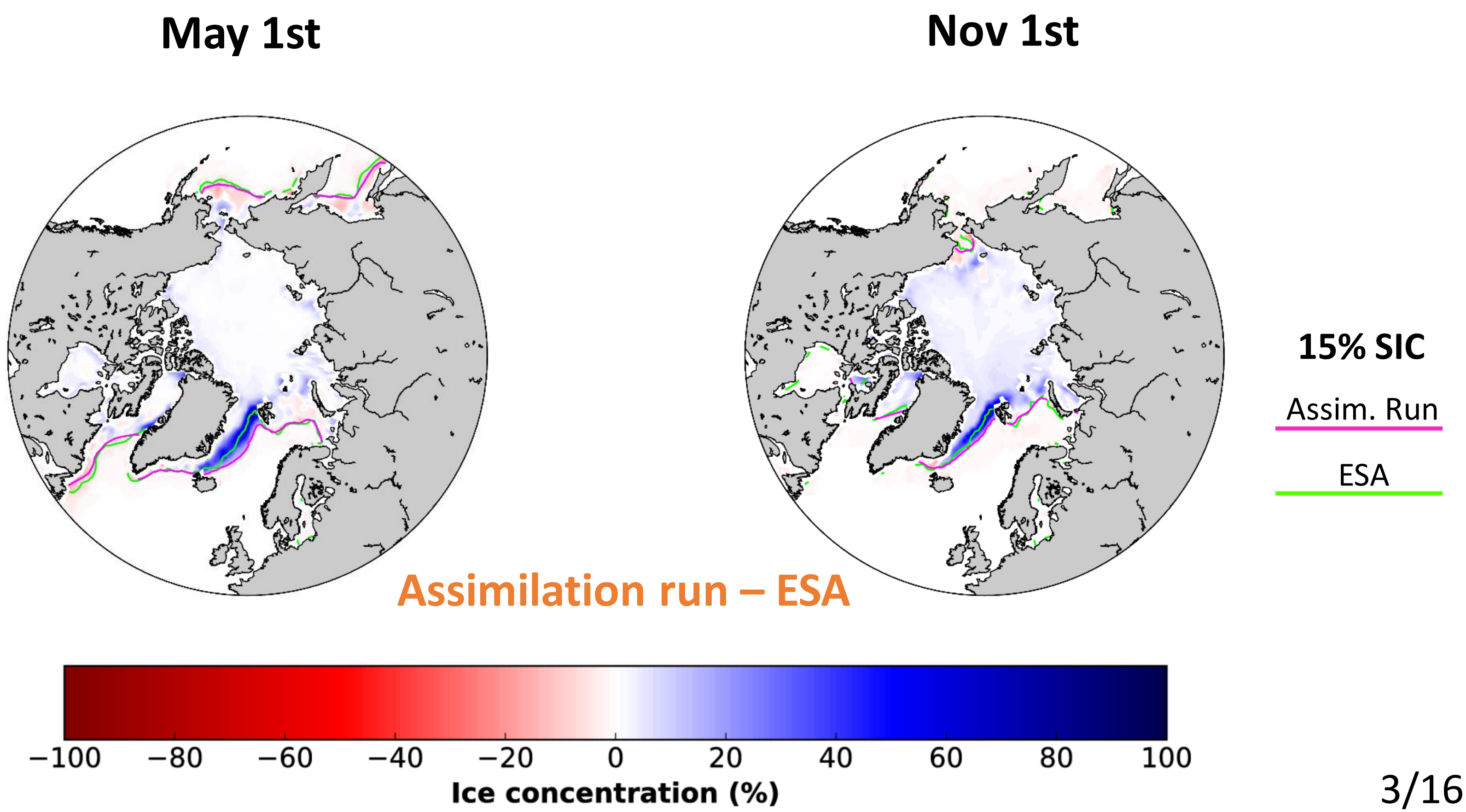
2. Motivation

- Large SIC bias from the first prediction day (vs NSIDC):



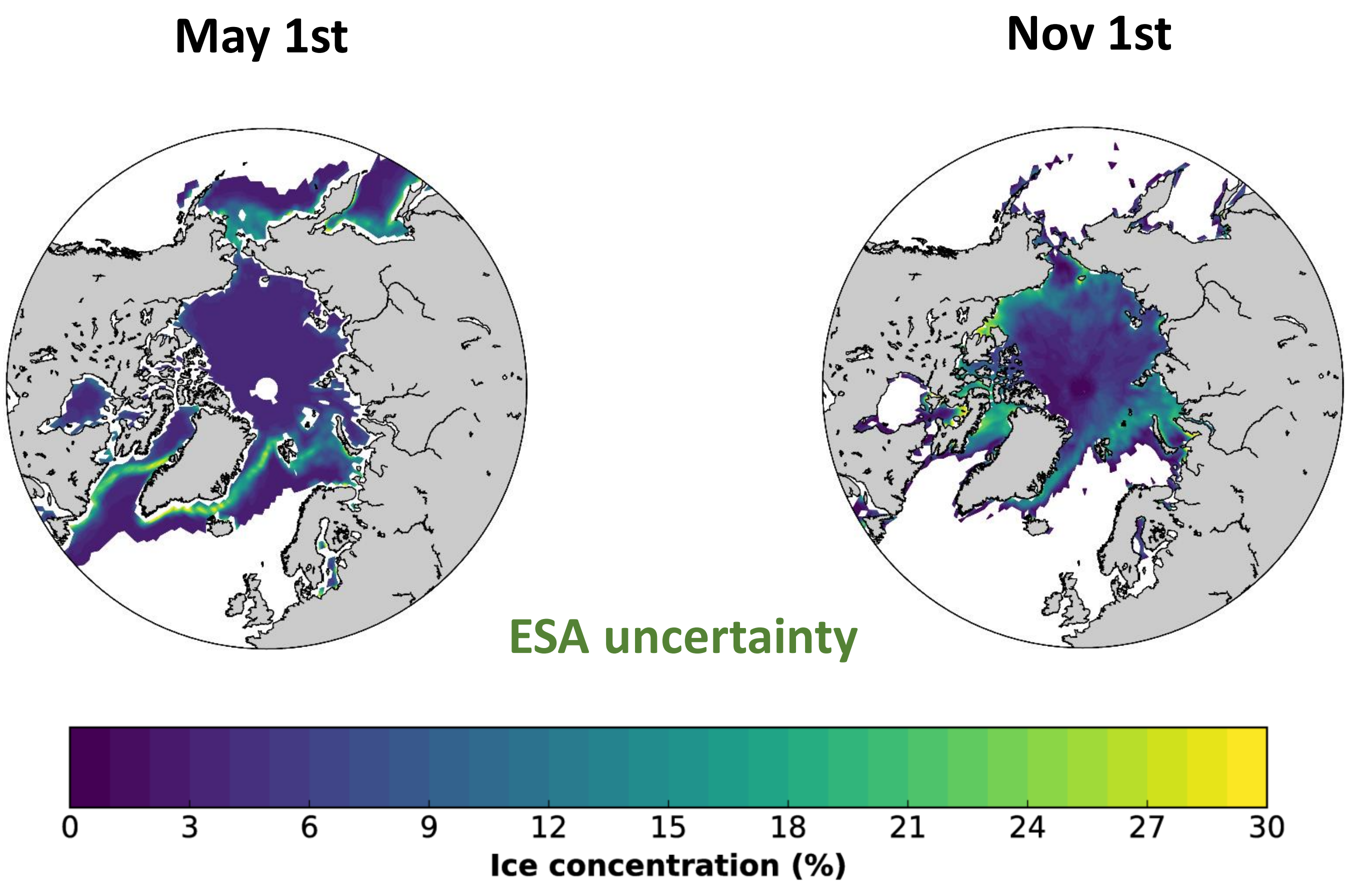
3.1 Particularities in the assimilation procedure

- The sea ice initial conditions (EnKF reconstruction) do not assimilate the target observations (ESA) adequately in some regions:



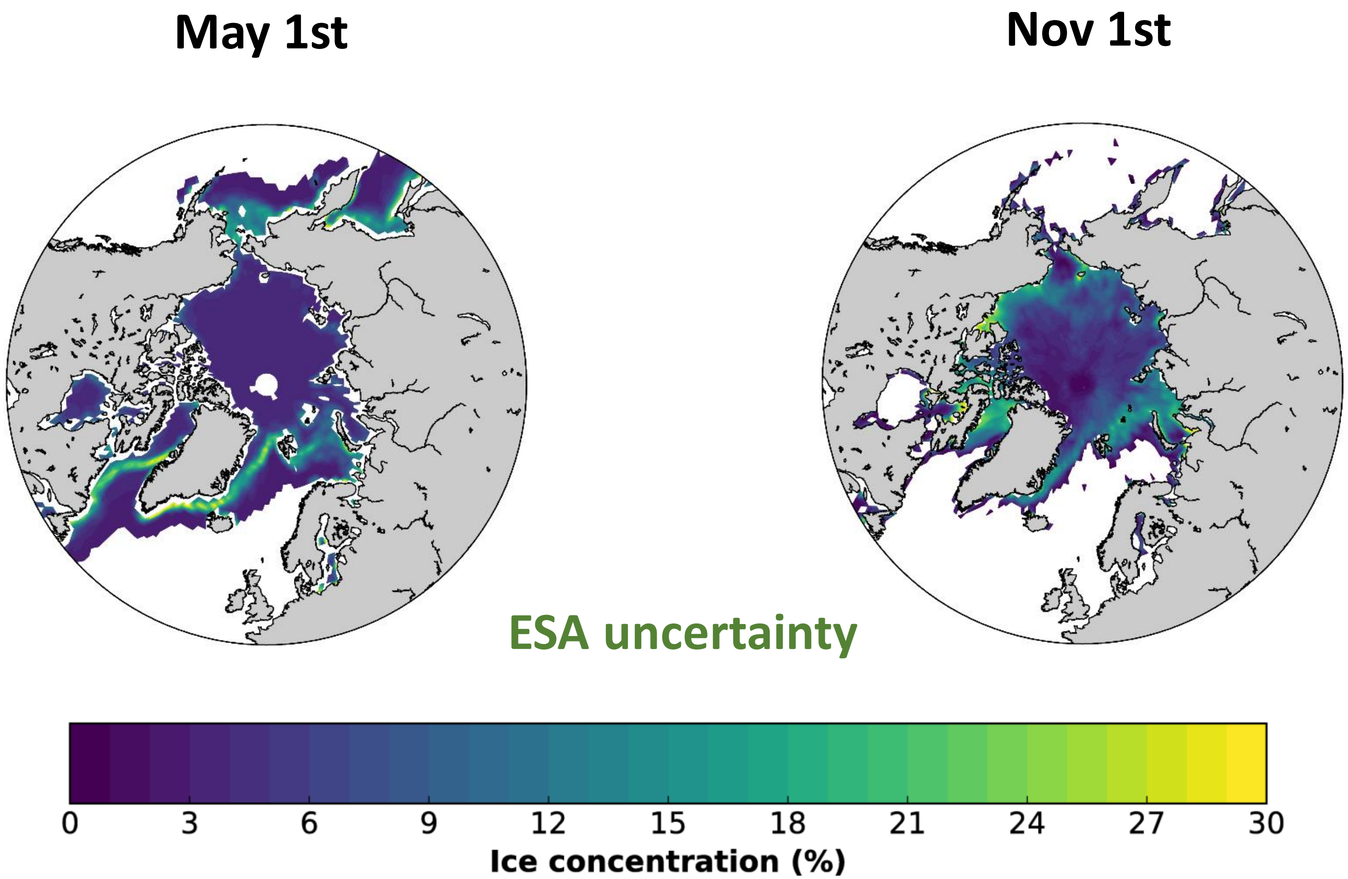
3.1 Particularities in the assimilation procedure

- The locations with a weak assimilation agree with the places with a larger observational uncertainty.



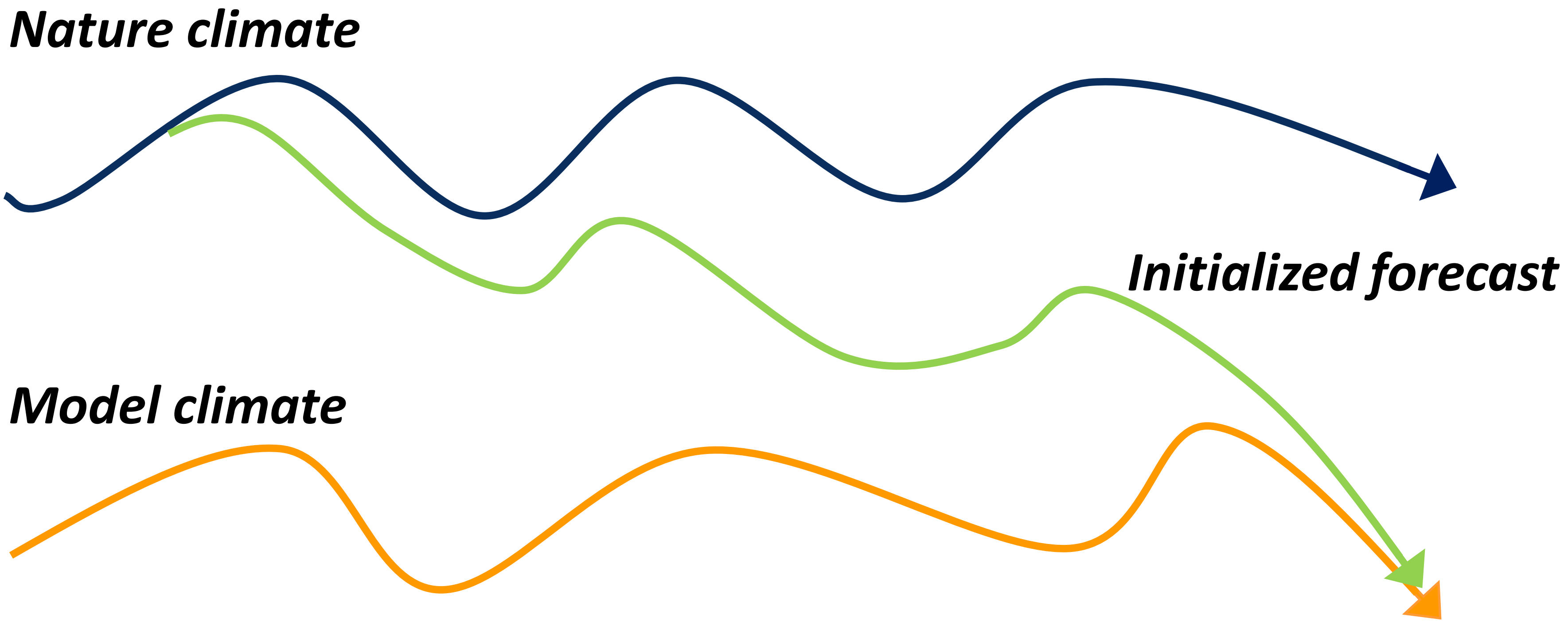
3.1 Particularities in the assimilation procedure

Given the large magnitude of this error, the rest of the errors will be quantified relative to the assimilation run (initial conditions).



3.2 Model drift

- The analysis of historical (and therefore uninitialized) simulations allows us to determine the systematic model bias.



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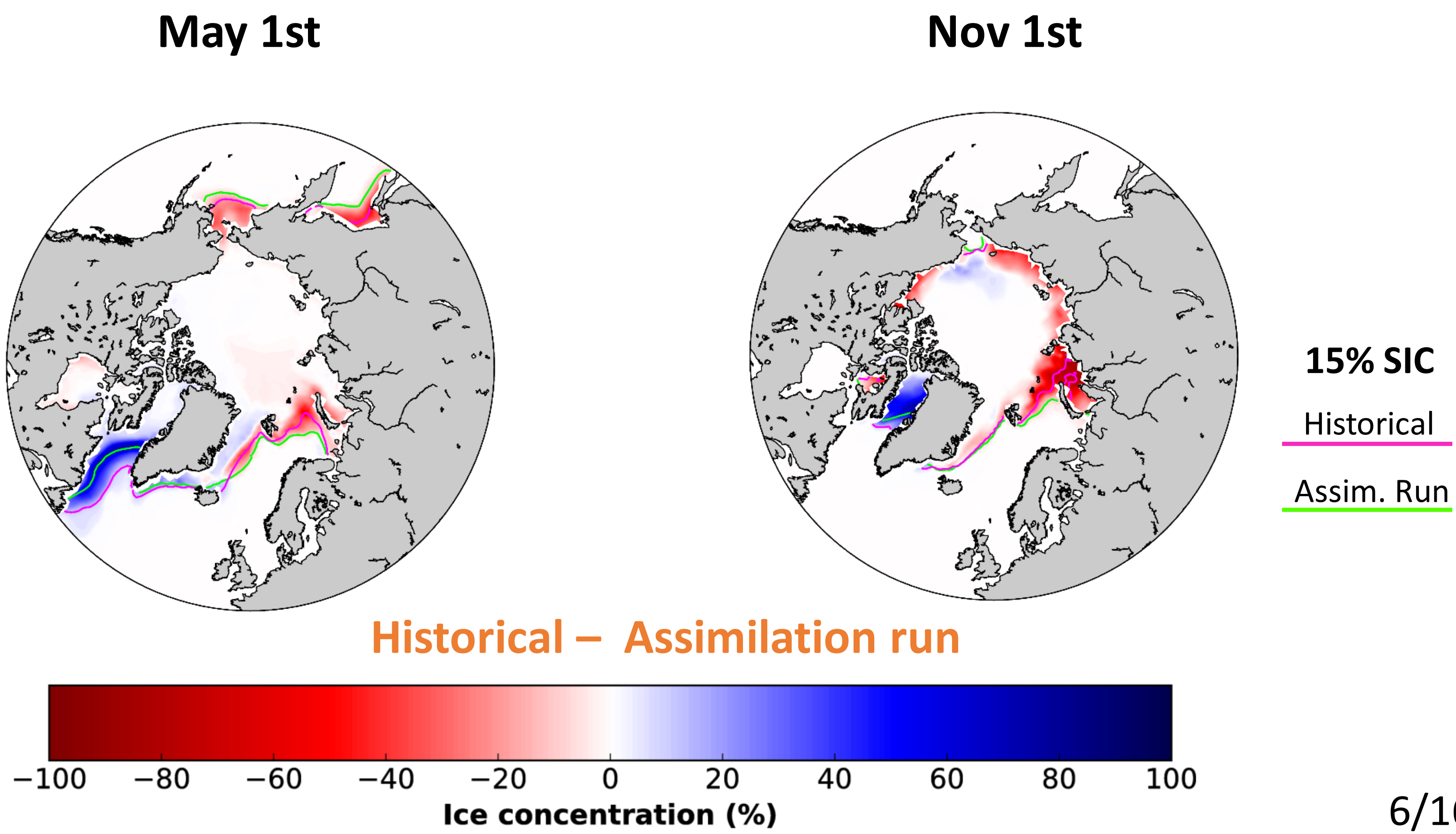
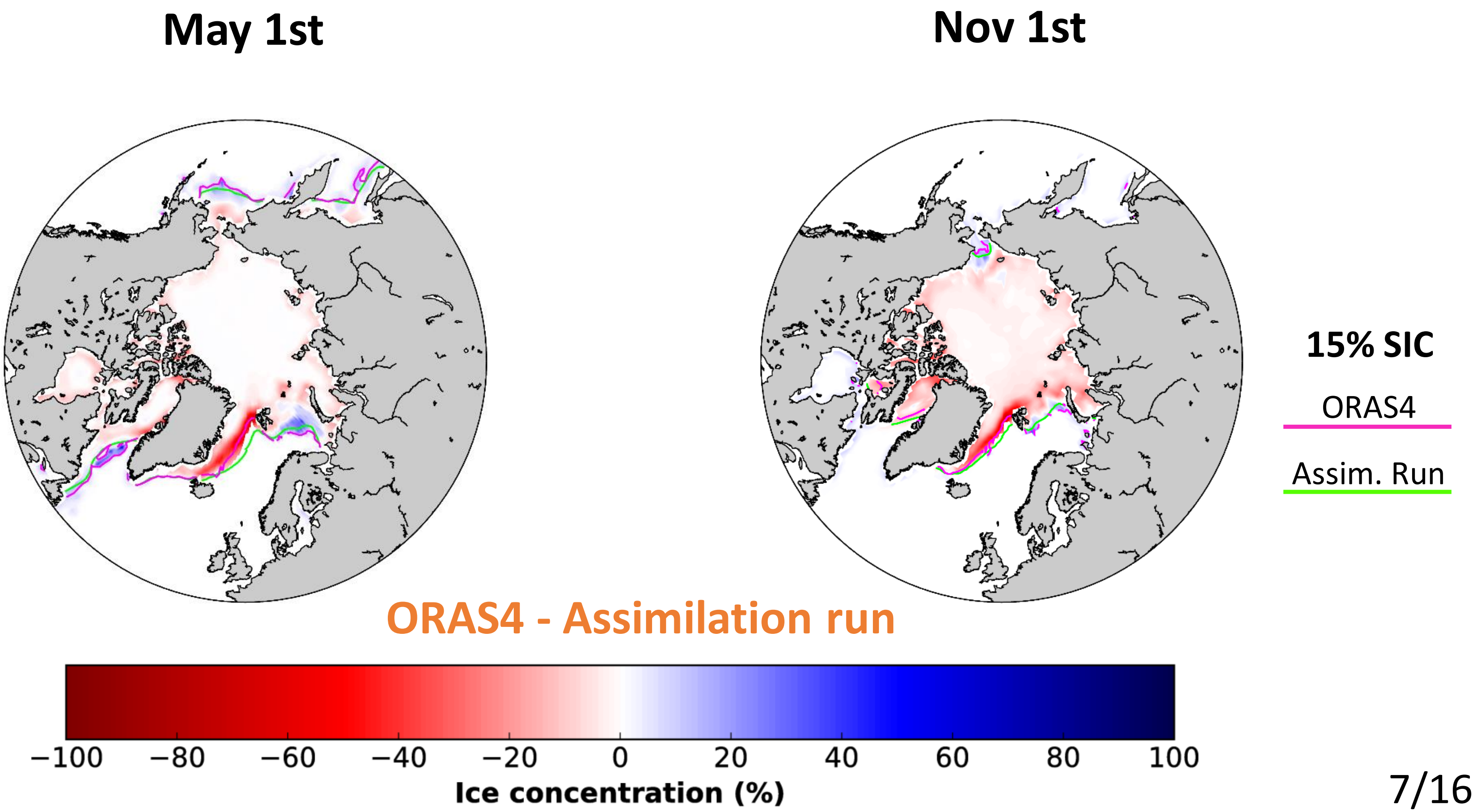


3.3 Inconsistency between the initialization products

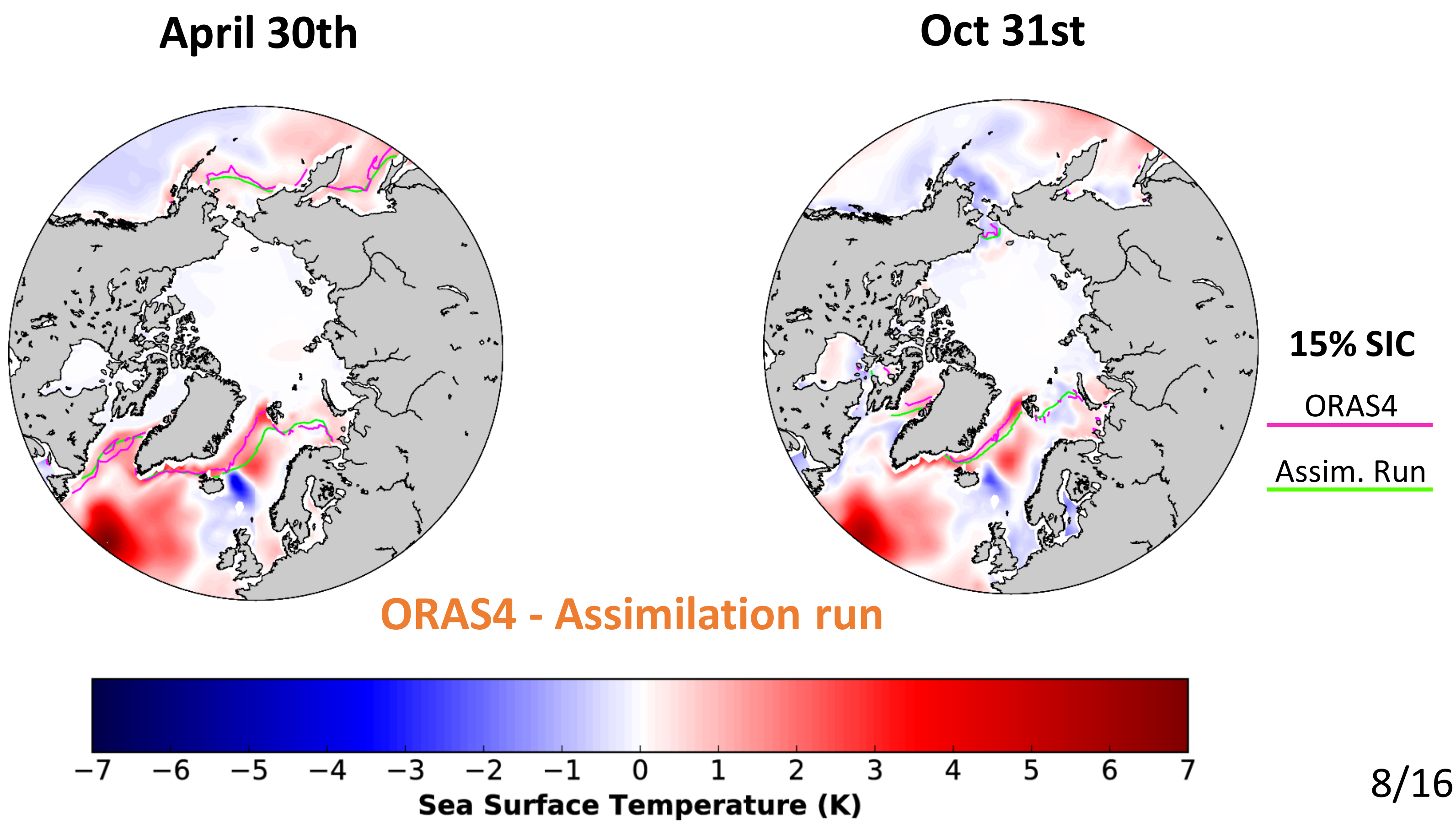
- Incompatibility between the sea ice of ORAS4 (ocean ICs) and the sea ice in the assimilation run (sea ice ICs).



Thanks to M. Balmaseda for the ORAS4 sea ice data

3.3 Inconsistency between the initialization products

- This incompatibility agrees with the SST difference for the restarts on April 30 and October 31.



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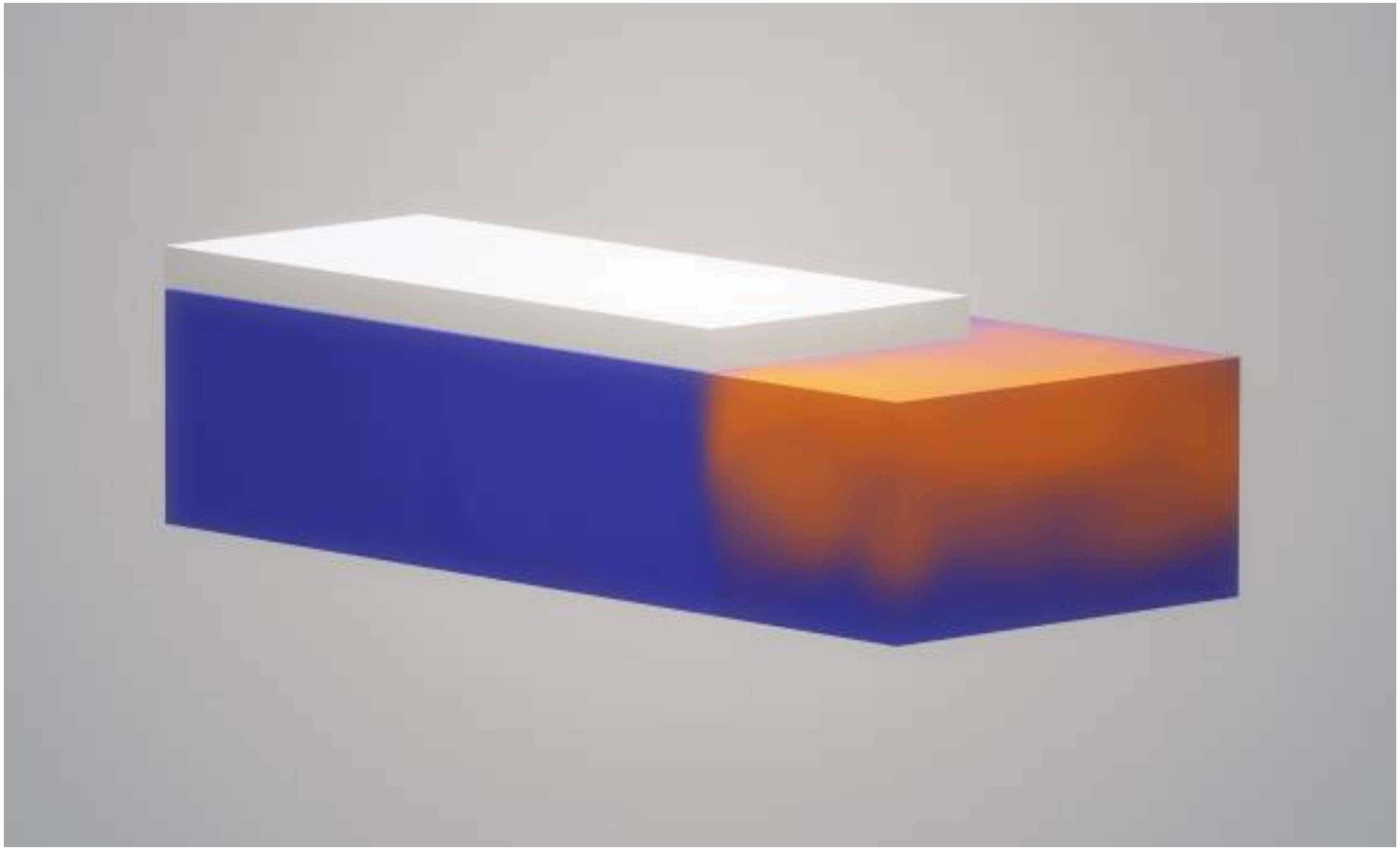
Consistent *ocean-sea ice initial conditions.*



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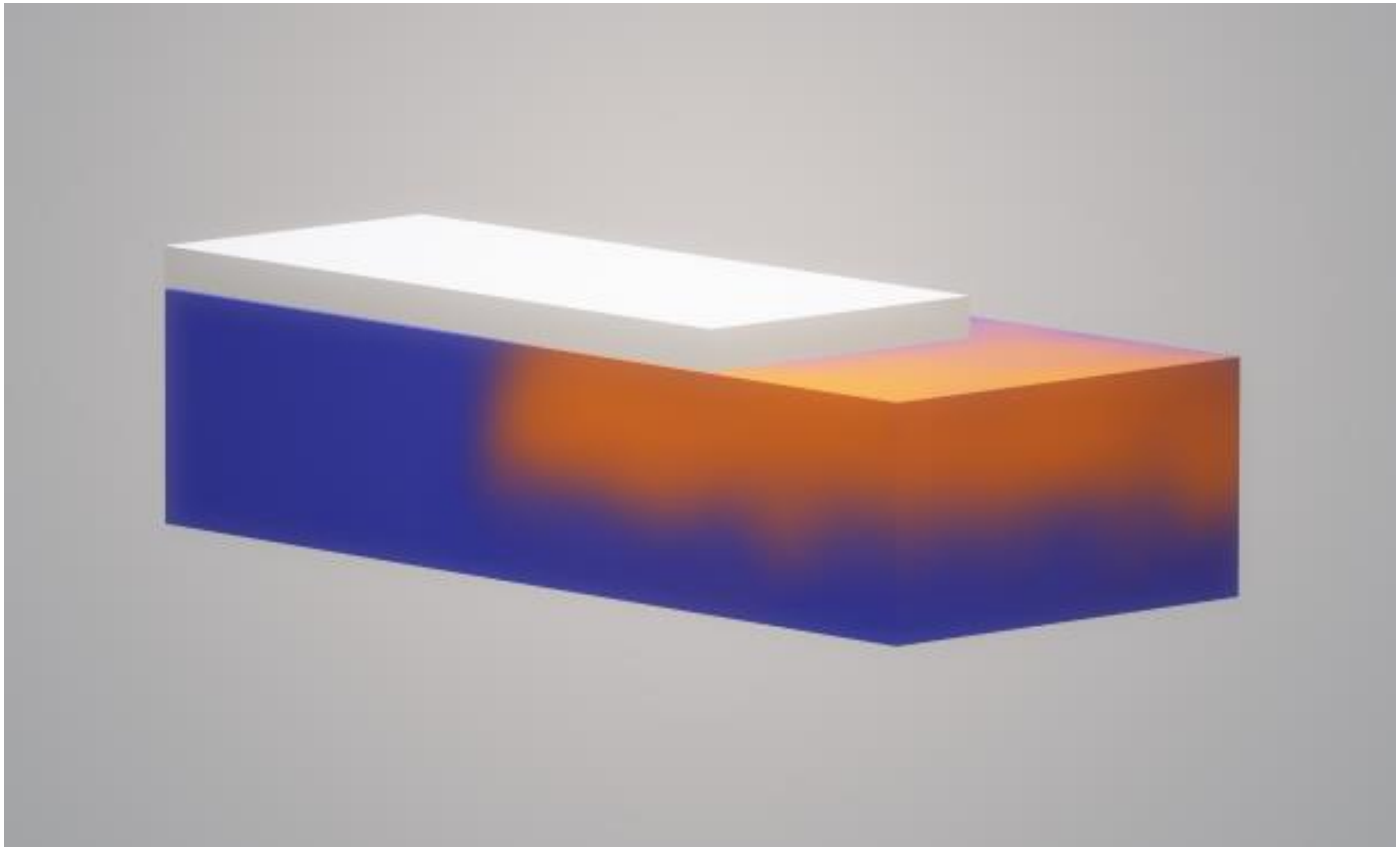

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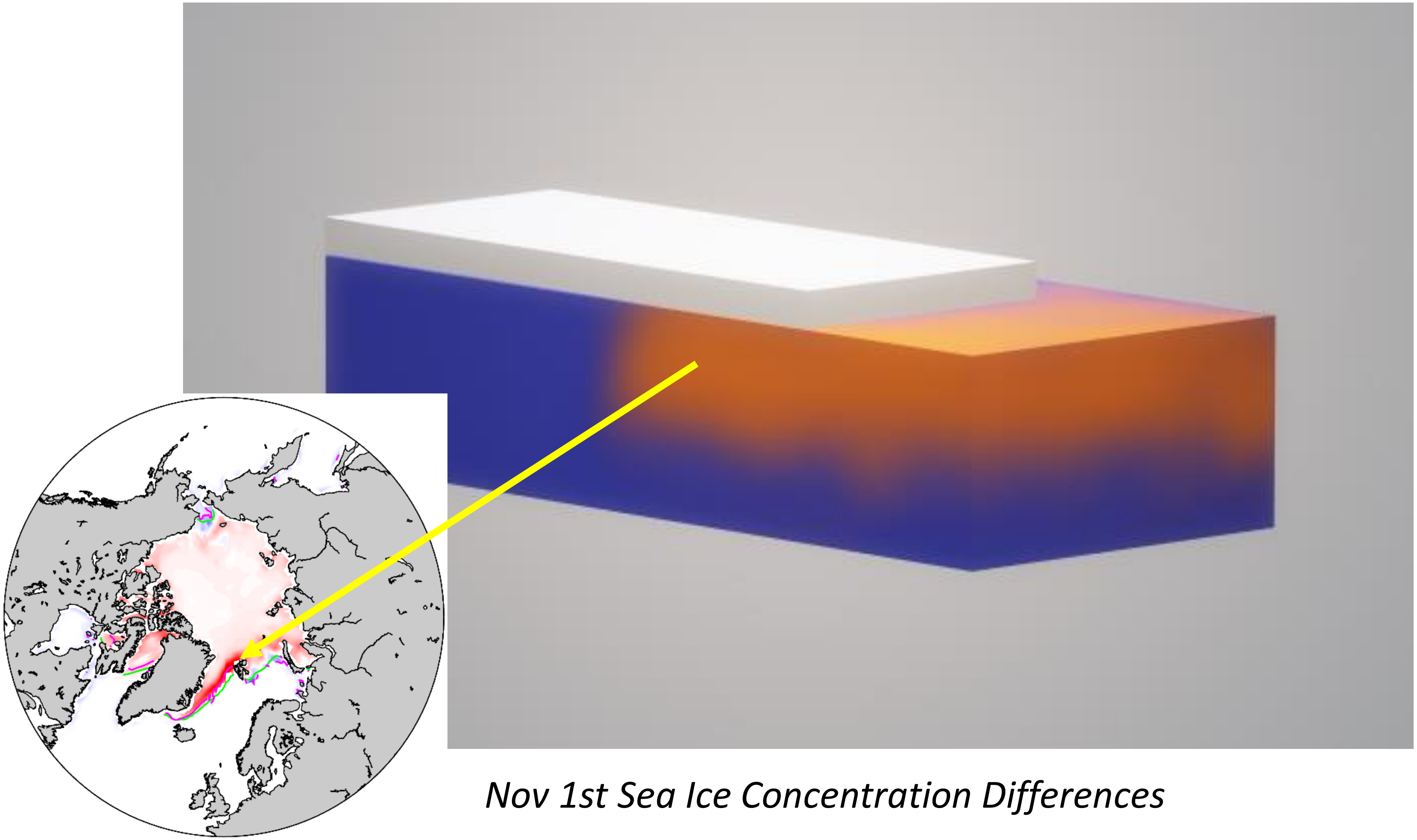
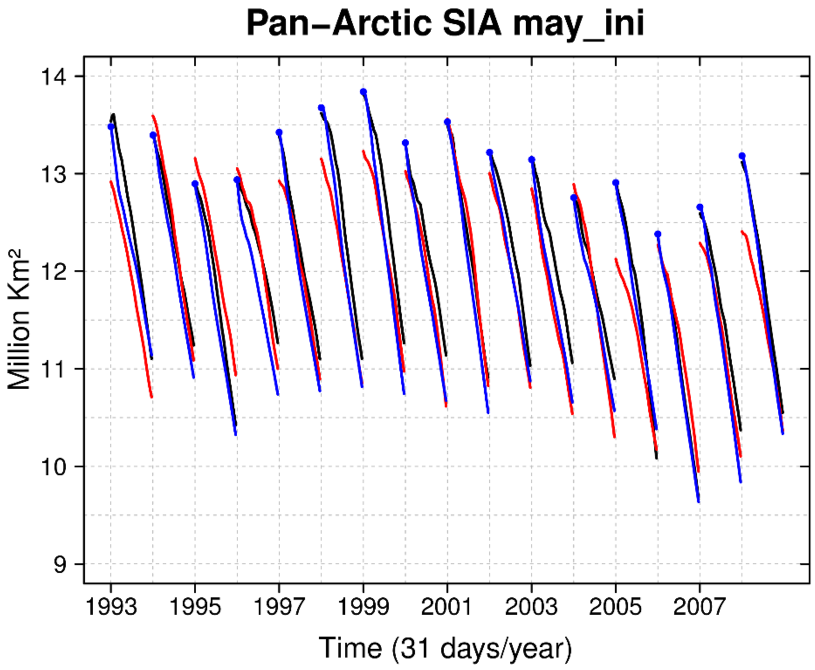
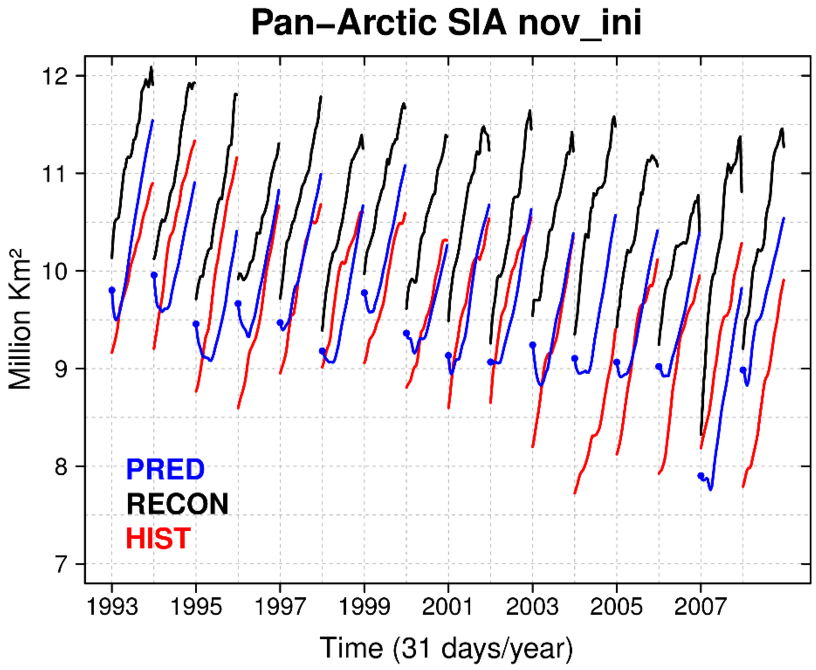


Nov 1st Sea Ice Concentration Differences

4.1 Error evolution in the Sea Ice Area

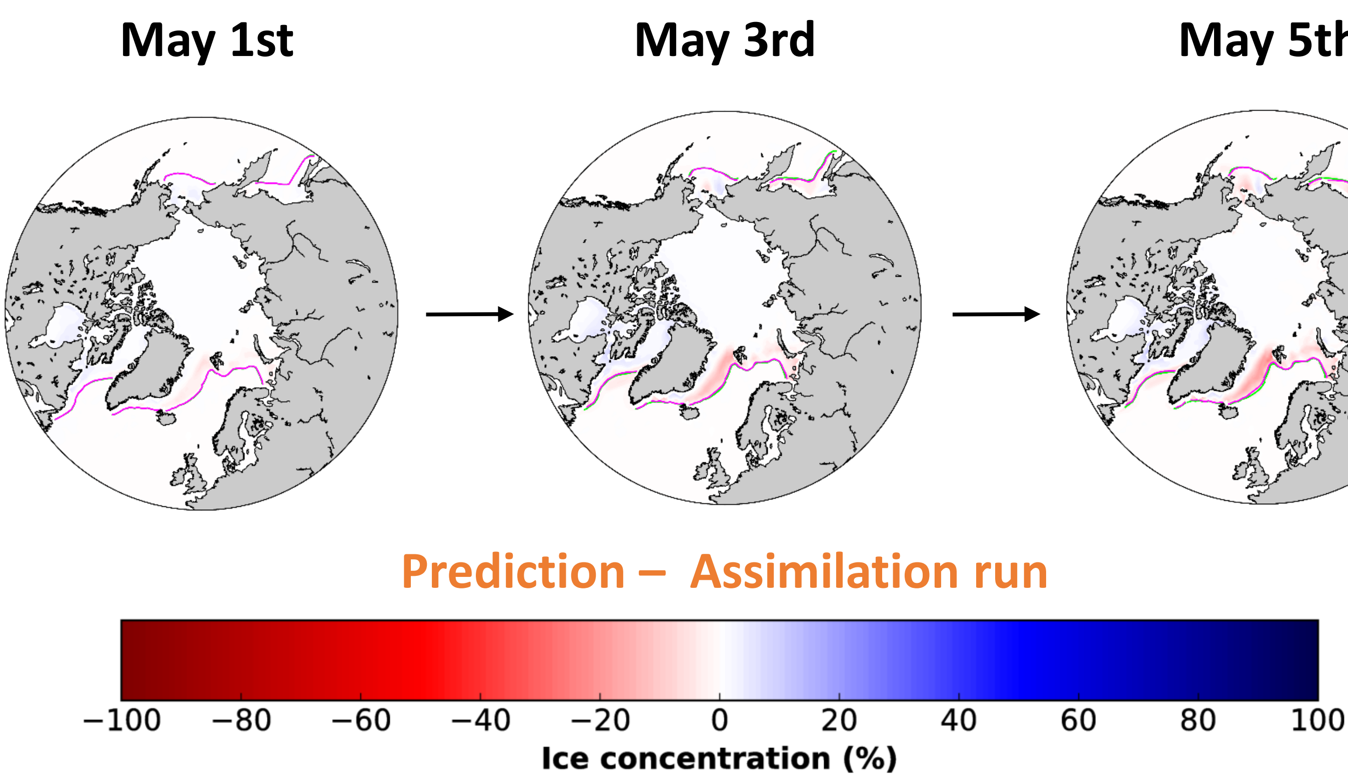
- The forecasts drift towards their model attractor in ~1 week.
- The shrinking (growing) trend in May (November) favours (hampers) the *absorption* of the initialization shock.





4.2 Spatial evolution of the forecast errors

- We expect a fast response in the forecasts in which the warmer ocean below degrades the overly extensive sea ice conditions from the assimilation.



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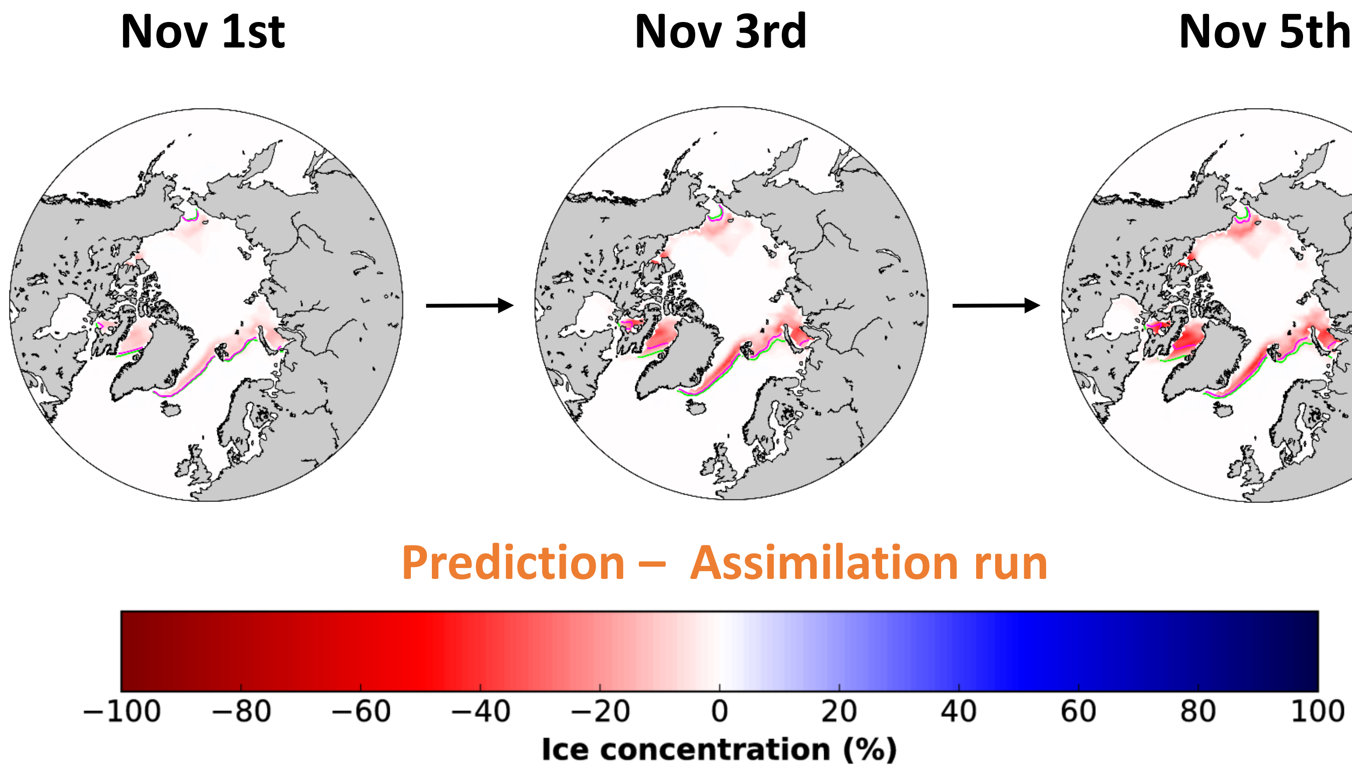
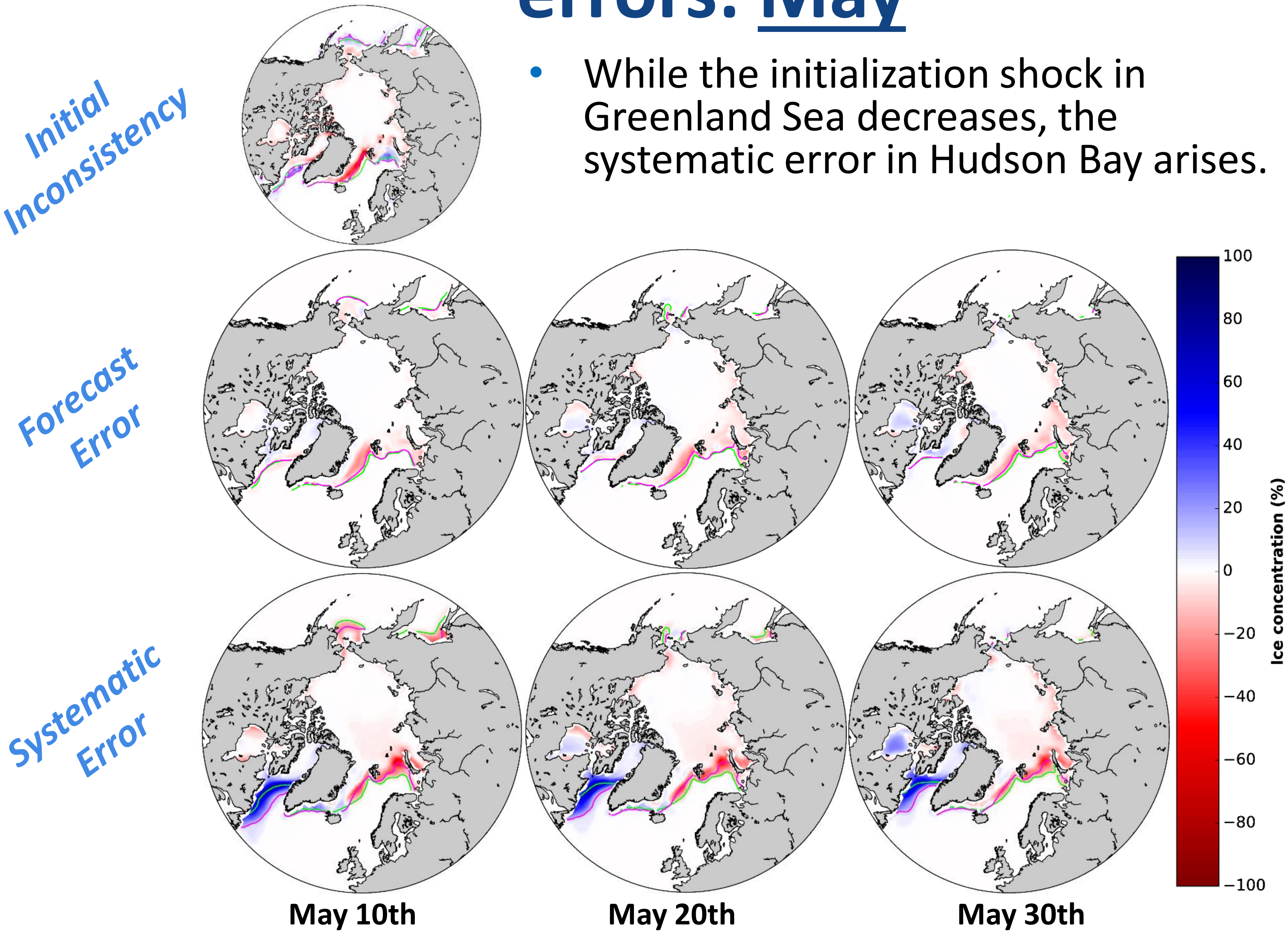


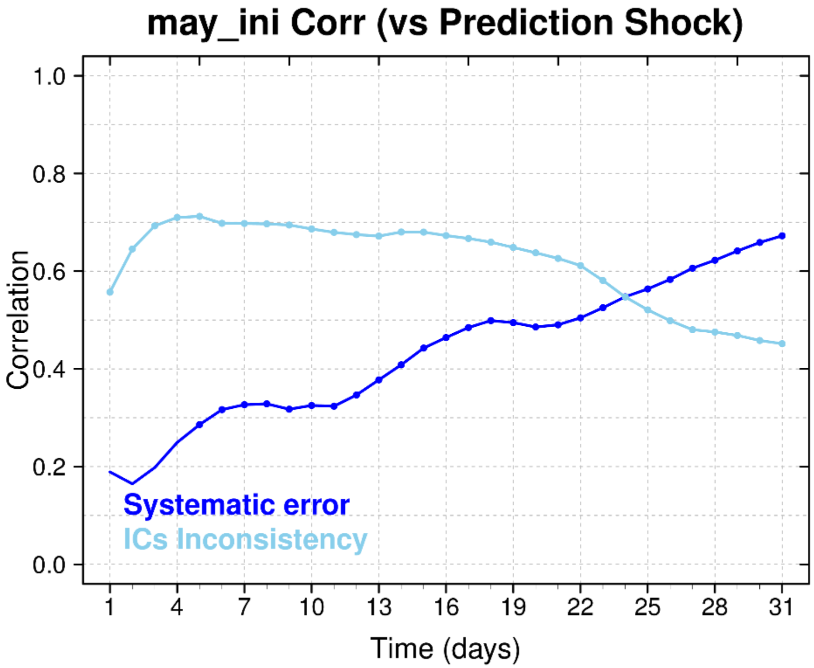
4.2 Spatial evolution of the forecast errors: May

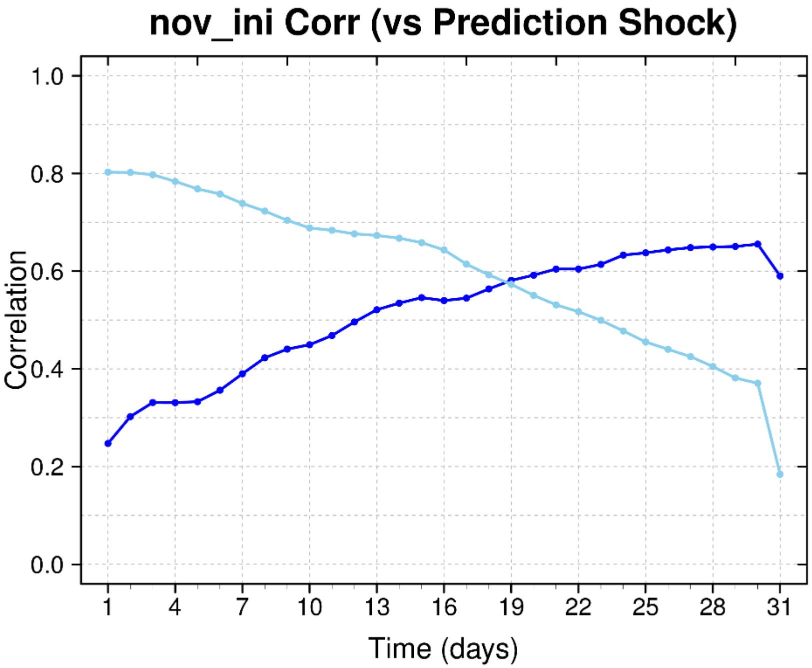
- While the initialization shock in Greenland Sea decreases, the systematic error in Hudson Bay arises.



4.2 Spatial evolution of the forecast errors

- After 25 (19) days the systematic model error becomes the largest contributor to the forecast error in May (November).





Conclusions

- **Inconsistent initialization products (generally a too warm ocean) impact the predictions (leading to an extensive sea ice melting the first days).**

- The impact of initialization incompatibilities depends on the initialization date and the seasonality of the systematic error.

- Forecast errors do not reach the systematic bias by the end of the month. Model drift takes more than one month to settle.

- The initialization shock dominates the forecast error the first 25 (19) days in May (Nov.). After that, it is the systematic error the major contributor to the total forecast error.

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Thank you

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